Tracer Evolution at High Latitudes in Winter (SOLVE)

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from
R. Alan Plumb, Principal Investigator

Massachusetts Institute of Technology
Building 54, Room 1712
77 Massachusetts Avenue
Cambridge, MA 02139

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Activities

Prior to the SOLVE deployment, we modified and ran a chemical transport model (CTM), to set up a stratospheric climatology for 1 September, 1999. During and immediately following the SOLVE deployments, we ran the model in near-real-time and used these results in conjunction with SOLVE observations to draw conclusions about stratospheric transport.

Those involved in these activities, at all stages, were Dr. Alan Plumb (PI), Mr. Will Heres (information systems manager/programmer), and Ms. Jessica Neu (graduate student).

Science Details

Prior to and during the SOLVE campaign, we ran tracer experiments with the three-dimensional "MATCH" CTM, driven with the NASA DAO assimilated winds and temperatures. Winds and temperatures for the period 980901-990831 were recycled for 10 years to set up a climatological state appropriate for 990901; subsequently, the model was run through the SOLVE winter (through 000331) using contemporaneous winds and temperatures. Tracers run were CO_2 (using an historical time series for surface CO_2 extrapolated after mid-1999); CFC-11, NO_y, N_2O, and age. Sources and sink rates for CFC-11, N_2O and NO_y were specified from output from a two-dimensional model (no sedimentation of NO_y was included). For the most part, tracer structures on isentropic surfaces were qualitatively consistent with those observed. However, the dynamic range of tracer mixing ratios at ER-2 altitudes in early winter was much less than observed: within the vortex, the model has (marginally) inadequate descent of tracer isopleths at this time. However, later in the winter, agreement between model and observations is very good. We have analyzed many aspects of the model results during this period, focusing on the diabatic and tracer isopleth descent, and on mixing between vortex and mid-latitude air. This work is described in Plumb *et al.* [2001].

Publication

Plumb, R.A., W. Heres, J. L. Neu, N. Mahowald, J. del Corral, G. C. Toon, E. Ray, F. Moore, and A. E. Andrews: "Global tracer modeling during SOLVE: high latitude descent and mixing" Submitted to *J. Geophys. Res.* (SOLVE Special Issue), 2001